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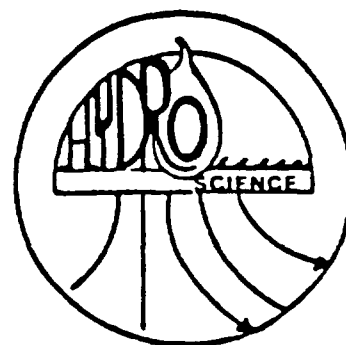
## Characterization of Surficial Materials and Soil Sampling Results Calumet Containers Site Hammond, Indiana

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October 1988

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CHARACTERIZATION OF SURFICIAL MATERIALS  
AND SOIL SAMPLING RESULTS, CALUMET CONTAINERS SITE  
HAMMOND, INDIANA

FINAL REPORT

Prepared for:

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## INTRODUCTION

This report contains the results of on-site investigation of soils and laboratory analyses of soil samples from the Calumet Container Site, Hammond Indiana. This work was done by Hydrosience Associates, Inc. as part of a remedial investigation undertaken by the Indiana Department of Environmental Management.

## PHASE I FIELD RESULTS

The objectives of the first phase of soil analysis at the Calumet Container site were to: 1) delineate zones of relative soil disturbance and approximate depth of fill throughout the area, and 2) identify the approximate depth of the water table. Observations were made at 37 points on a 100' grid (see Figure 1) on May 12, 1987. Gravely fill and other subsurface obstructions severely hampered the ability to take cores with the thin-wall tube soil probe; consequently, few observations of depth to permanent and seasonal water table were made. However, the tile probe penetrated the fill at 15 observation points, allowing some general conclusions concerning extent of soil disturbance and depth of fill throughout the area.

**Water Table** Three observations (20+50E/18+00N, 20+50E/11+00N, and 23+50E/15+00N) indicated maximum depth to the zone of permanent saturation at 30 inches. At 20+50E/18+00N seasonal high water table appeared to be about 18 inches (12 inches above the permanent water table). Extensive mixing of soil horizons made interpretation of water table based on degree of two-chroma mottling difficult. The soil pits that were dug for the Phase II soil sampling allowed more detailed observations of the water table depth. Water table observations obtained during this phase are discussed under the Phase II Field Results.

**Extent of Soil Disturbance** Air photo interpretation had identified the northwestern part of the site as a zone of minimal soil disturbance. None of the 37 observation points could be characterized as undisturbed soil. The "undisturbed zone" has a minimum of 12" of fill, and exceeds 12" (the maximum depth of penetration) in at least two locations).

**Depth of Fill** The fill had too much rubble to allow penetration by the tile probe at 22 of the 37 observation points. Maximum penetration at most of these sites ranged from 3 to 18 inches. However, penetration to unobstructed soil zones by the tile probe was achieved at 15 locations. Figure 2 shows the estimated depth of fill, where penetration was achieved. The depth of fill generally ranges from 24 to 36 inches throughout most of the area. Two zones of shallower fill are evident: 1) the northwest corner where fill of 12 inches was observed, and 2) south of the pond where fill depths of 18 and 20 inches were observed. The thickest fill was observed along the southwest boundary (36 inches), and in the center of the pit observed on air photos (see Figure 2 and/or Figure 11 of the Site Sampling Plan). The consulting report by WAPORA, Inc. surmised that the marsh area in the eastern part of the site did not contain fill; however, we identified 24 to 30 inches of fill in this area (Figure 2).

## PHASE II FIELD RESULTS

The objectives of Phase II were to collect surface and subsurface soil samples to: 1) determine the geographic extent and types of contamination of the surface soil, and 2) determine the extent to which contaminants have migrated to the subsurface soil. Holes dug to collect subsurface samples also allowed more detailed observations pertaining to the depth of the water table. Complete data sheets describing each sampling point are included in Appendix A.

**Depth to Water Table** Depth to permanent water was estimated at each sample location, based on soil color and seepage of water into the bottom of the hole. Several factors may have affected the accuracy of these estimates: 1) heavy rains on May 11, 1987 resulted in soil ponding in depressions above the permanent water table, 2) soil sampling sites were taken at locations up to 5' distant from the grid stakes and were often at slightly different elevations.

Given the above discussed sources of possible error, it was expected that water table elevations calculated from the site's topographic map would show considerable variability. Surprisingly, this was not the case. Figure 3 shows a preliminary water table map of the site based on soil observations. The general flow appears to be from south to north with a difference in elevation of over two feet. The only observation that does not fit this general pattern is at SD2, near 22+50E/16+50N, where the estimated elevation of 584.7' lies near the 584' isopleth. Since SD2 and SD3 were sampled in depressions that lay at a lower elevation than the grid marker, it may well be that the observed water tables at SD2 and SD3 (which were interpreted in the field notes as a perched water table) may actually be close to the permanent water table. The maximum observed depth to water table was 30" (if we exclude the 32 inch estimate at 22+50E/16+50N as incorrect), with water table most commonly falling in

the range of 24 to 30 inches. This confirms to more limited water table observations in Phase I.

More accurate measurements of the shallow water table, taken from observation wells a year later (May 1988), indicate a more northeastward direction of flow (Figure 4). Nevertheless, a comparison of Figures 3 and 4, indicates that soil observations can be a useful preliminary source of information on depth to water table and general direction of flow.

**Geographic Extent of Contamination** Figure 5 shows the location of all soil sampling points. Locations where sludge was sampled and/or observed and maximum volatiles as measured in the field are also shown. Sludge was observed at 6 of the 12 points on the systematic sample grid, and at all three depressional sample locations. Sludge was also observed at two of the Phase I observation points (18+00N/21+50E and 14+00N/23+50E). Volatile organic vapors above background levels were observed at 8 locations, and readings exceeding 100 ppm at 4 locations. The maximum concentration was 200 ppm at 12+00N/21+00E.

Sludge was observed in two major forms: 1) dense lenses or layers of black or gray tarry substance with little soil material mixed in, and 2) bituminous-looking fine sandy loam in which the sludge appears to be evenly disseminated through the soil material. In the first type flecks a brightly colored pigments or compounds are commonly present. Colored specks occur, but are less frequent in the second type of material.

**Degree of Migration of Contamination** The bituminous fine sandy loam sludges tend to occur at deeper levels within the soil, and at location SD1 become denser with increasing depth. This would appear to indicate migration of sludges into the soil profile.

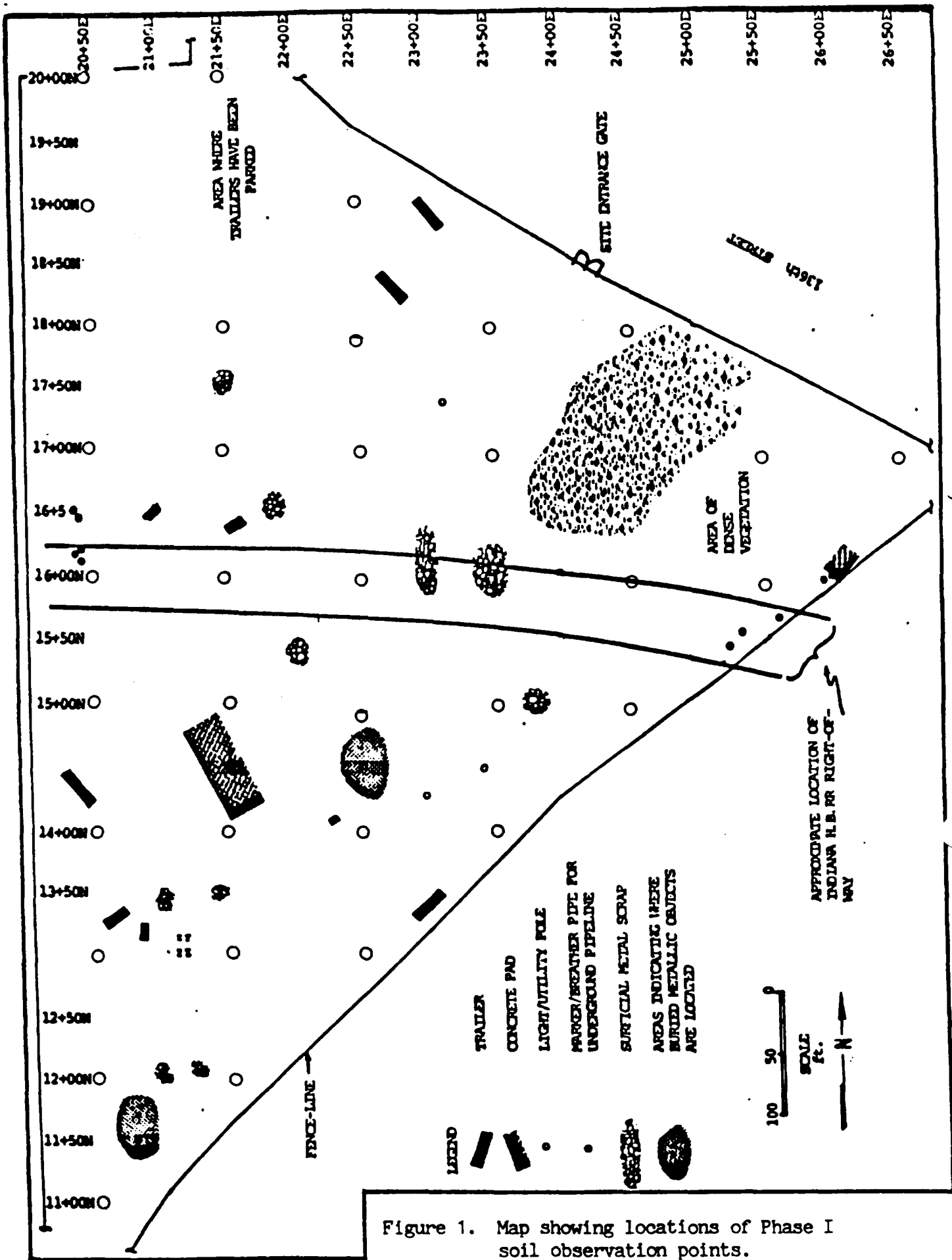


Figure 1. Map showing locations of Phase I soil observation points.





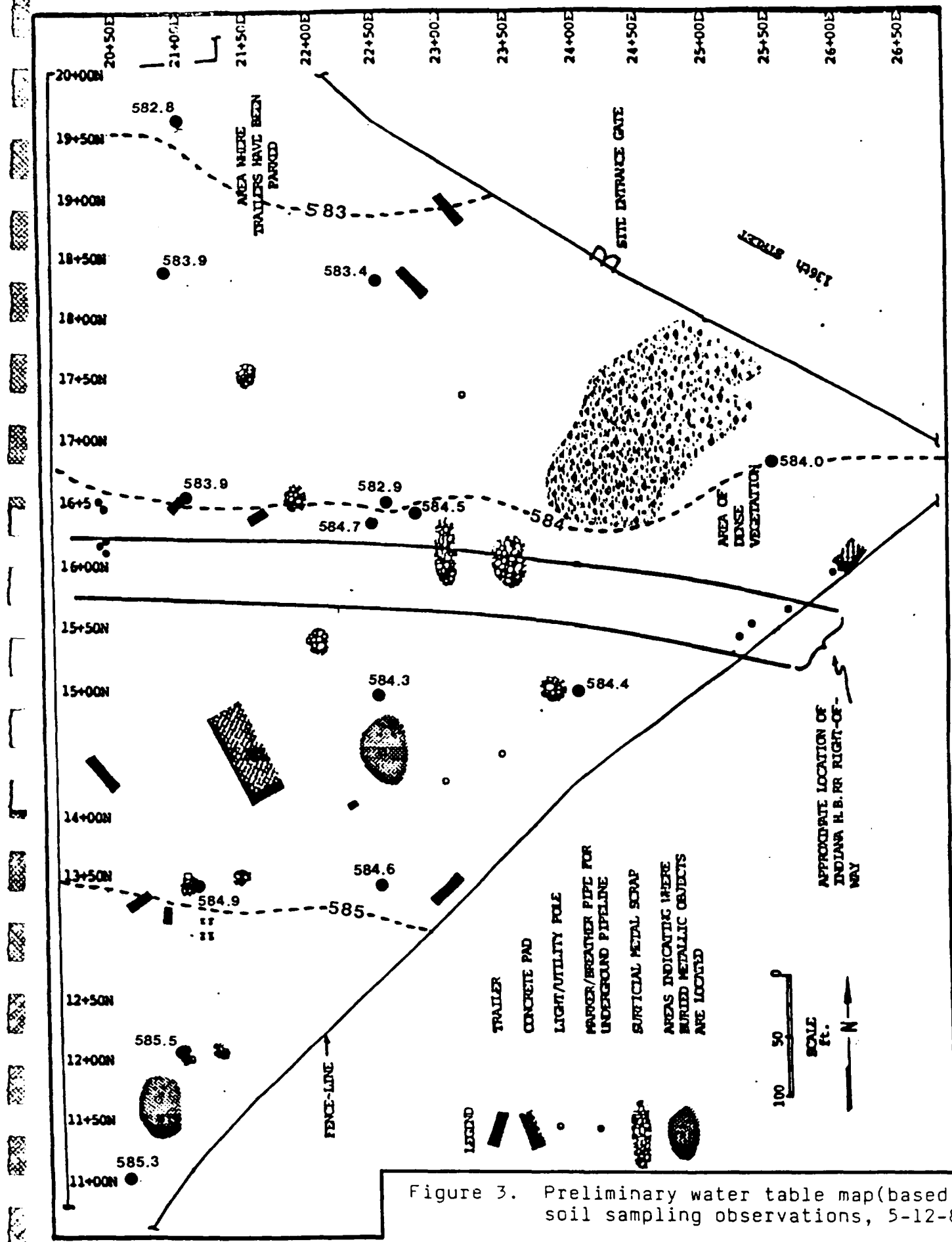


Figure 3. Preliminary water table map(based on soil sampling observations, 5-12-87)

.....584..... Line of equal water table elevation

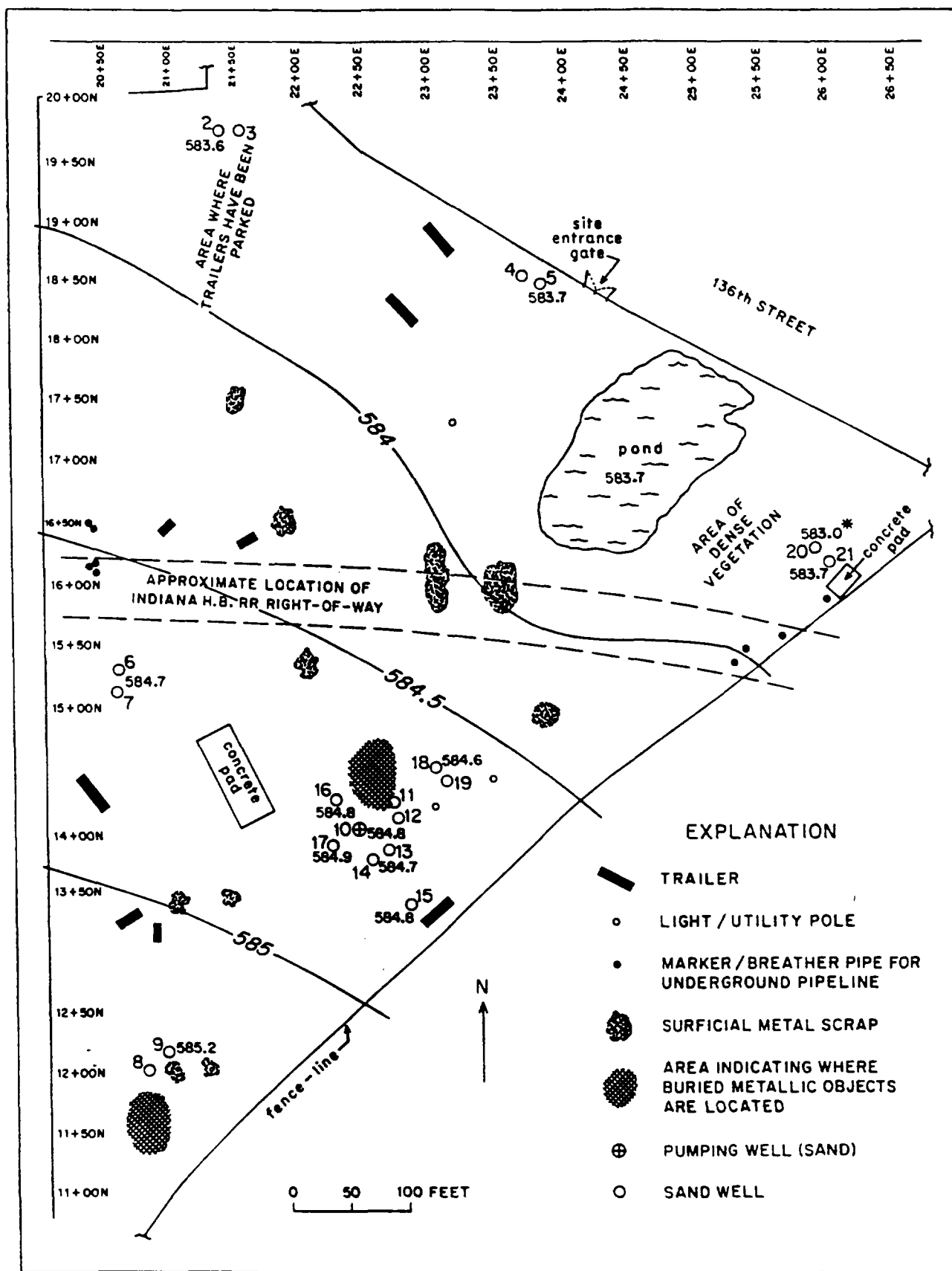


Figure 4. Water table map of sand aquifer on the Calumet Container Site.

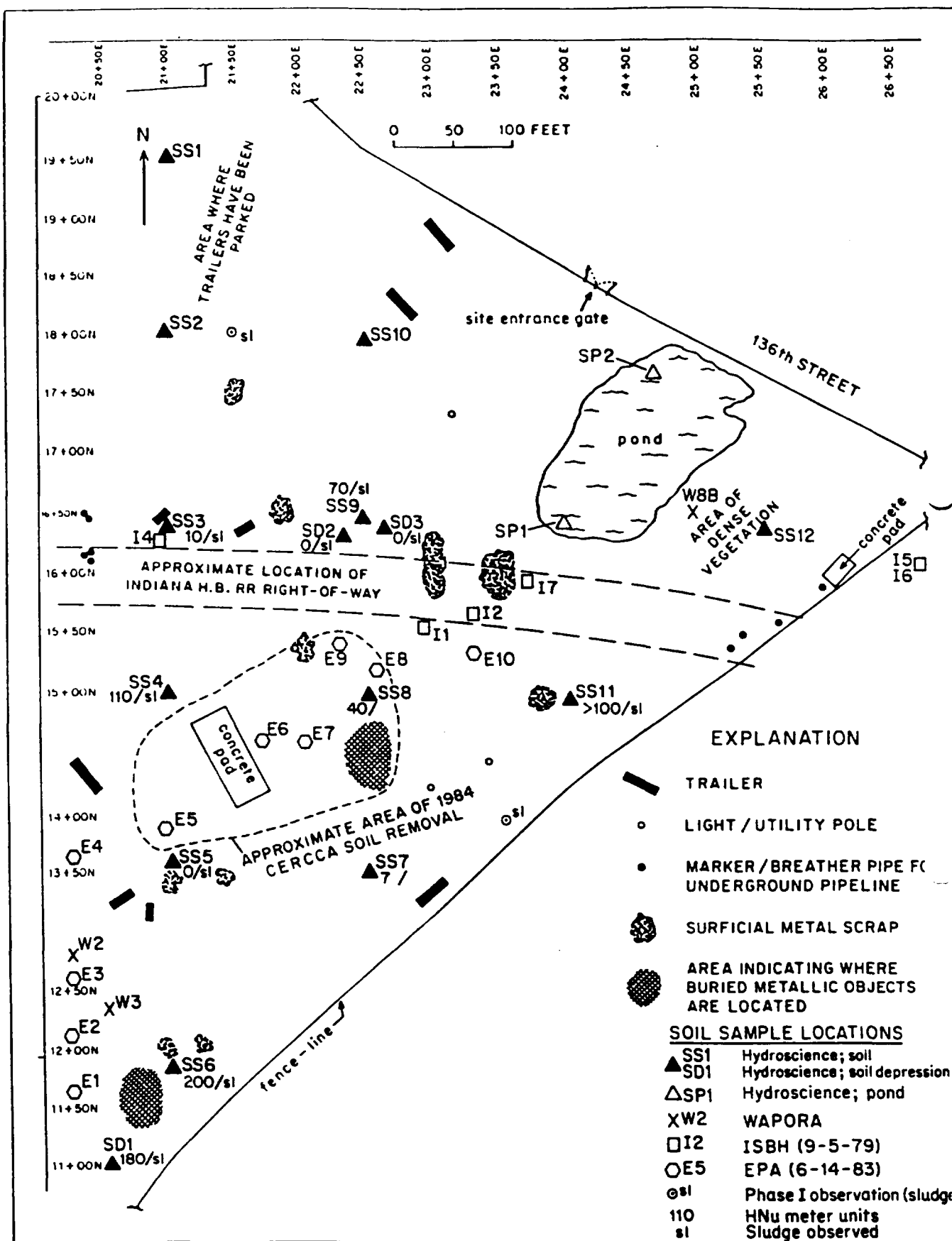


Figure 5. Location of soil sampling points and field measurements of volatiles.

## LABORATORY RESULTS

Soil samples were originally collected by Hydrosience on May 13-14, 1987. Due to deficiencies in the analyses provided by the laboratory subcontractor, Environmental Consultants, Inc. (EC), a second sampling effort was conducted during the dates of October 15-16, 1987, with laboratory services provided by EMS Laboratories, Inc. A total of 38 samples (including duplicates) at 15 locations were taken. Sampling locations were essentially the same for both sampling efforts. Sample location numbers for the October sampling round were assigned a "II" prefix on the field data sheets (Appendix 1). A prefix "SS" indicates a grid (systematic) sample point, and a prefix "SD" indicates a spot sample taken in a depressional area. The first number indicates the sample location (see Figure 5) and the second number indicates the depth increment, with number "1" indicating the surface sample. Thus, SD2-2 is the second depressional sample location, taken from a depth between the surface (SD2-1) and the lowest sample (SD2-3). The lowest sample was taken just above the water table, if feasible. Laboratory results from the May sampling round have been previously submitted to the IDEM. The laboratory results of the May sampling are not discussed in this report.

The following tables summarize the laboratory results for the October soil sampling at the Calumet Container site:

- Table 1 Summary of Grid Soil Analysis Results.
- Table 2 Summary of Spot Soil Analysis Results.
- Table 3 Contaminants by Sample Percentage Class.
- Table 4 Changes in Selected Contaminants by Depth.

The individual sample results are contained in Appendix B:

- Table B.1 Grid Samples.
- Table B.2 Spot Samples.

The data shown and summarized in these tables only includes 1) concentrations of heavy metals that exceed normal background levels as indicated by USGS Circulars 644 and 692, and Professional Papers 574-D and 575-F, and 2) all organics where concentrations exceed the detection limit. EMS Laboratory sometimes estimated concentrations where a constituent is present, but below the quantitative detection limit. An (est) appears after the constituent in the attached Tables where one or more of the values has been estimated.

### Heavy Metals

A total of 8 heavy metals (arsenic, barium, cadmium, chromium, lead, mercury, nickel, and selenium) were measured in concentrations above background levels in one or more soil samples. Only two samples

(SS1-2 and SS3-2 contained no metals above background). Lead was the most widely occurring metal above background (occurring in about 90% of the grid and spot samples). Figure 6 shows the maximum concentrations of lead measured at each sample location. The highest value was 38,000 ppm at SS9, and six other locations had samples exceeding 1,000 ppm (SS4, SS5, SS7, SS11, SD1 and SD3). Other frequently occurring metals in above normal concentrations were chromium (88.5% of grid and 83.3% of spot samples) and cadmium (65.4% of grid and 75% of spot samples). See Tables 1 and 2 for the range, average and frequency of occurrence of these and other metals.

### Organics

A total of 30 organic constituents were observed in the grid samples and 15 in the spot samples (see Tables 1 and 2). Every single soil sample had two or more organic constituents that were detected. Sample SS5-1 had the largest number of detected organic constituents (20) although concentrations of individual constituents were not exceptionally high (generally in to 1 to 2 ppm range). Figure 6 shows the highest total concentration of organic constituents at each sample location. The highest level was 6,481 ppm in SD1-3. Four other locations had concentrations exceeding 1,000 ppm (SS6, SS9, SS11, and SD3).

### Frequency of Occurrence of Contaminants

Table 3 groups the contaminants that were measured in the grid samples into four sample percentage classes. Three metals (arsenic, barium and mercury) occurred above background levels in less than one-quarter of the samples, and 20 of the organic constituents. Nickel, phenols, di-n-octylphthalate and ethyl benzene occurred in one-quarter to one-half of the samples. Cadmium, chromium, bis(2-ethylhexyl)-phthalate, toluene, m-xylene and o-xylene occurred in one-half to three-quarters of the samples. Finally, lead, cyanide, di-n-butylphthalate, methylene chloride and methyl ethyl ketone occurred in more than three-quarters of the samples.

The laboratory blank samples showed methylene chloride and methyl ethyl ketone, so the values for these constituents may be due, in part, to contamination in the laboratory. At least one soil sample taken by EPA from the site (see page 13) contained both methylene chloride and methyl ethyl ketone (2-butanone). The high value of 350 ppm of methylene chloride in SD1-3 probably reflects on-site contamination levels (most values are 1 ppm or less). Beyond that, it is hard to say how widely these two constituents actually occur on the site.

## Changes in Contaminants with Depth

Table 4 groups sample locations (total organics for grid and spot samples, lead, and cadmium) in three categories: 1) concentrations increase with depth, 2) concentrations decrease with depth, and 3) no obvious trend is evident with changes in depth. Total concentrations of organic constituents in the grid samples increased with depth at 5 sites, decreased with depth at 6 sites, and showed little change at 1 site. Total organics increased with depth at 2 of the 3 spot sample sites, and decreased with depth at the other. Lead increased with depth at 2 sites, and decreased with depth at all other sites except one where there was no obvious trend. Similarly, cadmium increased with depth at one site, decreased with depth at 8 sites and showed little change at one site.

## Comparison of Grid and Spot Samples

Average concentrations of above-background heavy metals in the grid and spot samples are generally similar except for lead, where the grid sample average of 2,470 ppm is twice that of the spot samples. This is due to the unusually high value of 38,000 ppm measured at SS9. Also, selenium was above background levels in four of the spot samples, but in none of the grid samples. Twice as many organic chemicals were measured in the grid samples as in the spot sample (30 vs. 15). The 15 organic species that were not measured in the spot samples tend to have lower concentrations than the organic constituents that occur in both the grid and the spot samples (generally less than 5 ppm). The average concentration of organic constituents in the spot samples were higher than the same constituent in the grid samples in 9 of the 15 cases (compare Tables 1 and 2). The rationale for sampling depressional areas was that contaminants may tend to be concentrated where surface runoff collects. The data do not indicate that this is a significant process for heavy metals, but does appear to support such a conclusion for the most widely occurring organic contaminants.

## Other Soil Analysis Results

Hydrosience reviewed IDEM's files on the Calumet Site for additional data that might be available on soil contamination at the site. The results of this review are summarized below:

1. In May 1979, WAPORA, Inc. collected samples from three locations which were analyzed for metals and cyanide. Samples 2 and 3 are in the southern part of the site and sample 8B is east of the pond (see Figure 7). The report that contains the analyses of these samples was prepared for the Calumet Container company.

2. The Indiana State Board of Health (ISBH) has collected soil samples on at least three occasions. On May 22, 1979, a total of six soil and soil/sludge samples were collected. The results for cadmium, chromium and lead (the only constituents that overlap the EMS analyses) are shown in Table 5. Hydrosience was unable to find any documentation of the location of these samples in IDEM files. On September 5, 1979 six more soil and soil/sludge samples were taken. Samples 1 and 2 were sludge/soil taken west of a pipeline excavation southwest of the pond; sample 4 was soil from north of the processing plant; samples 5 and 6 were taken from two depths at a location 50 feet south of 136th Street and east of the railroad as off-site background samples; and sample 7 was taken from the excavated pit. The results are shown in Table 5 and the locations on Figure 7. IDEM files also indicate that two soil/sludge samples that were taken by ISBH on May 22, 1980 in the very southern part of the site. However, Hydrosience found no records of actual laboratory results for these samples.

3. A report prepared by Soil Testing Services (STS) for the State of Illinois Attorney General's office, dated October 18, 1980, contains results of analyses of 21 soil samples taken from and/or in the vicinity of the site. Hydrosience found only the summary table from the report in the IDEM files, which was very hard to read. In the 21 soil samples, phenols were found in 18 samples, ranging from 0.05 to 1.5 mg/l. Toluene concentrations of 28,900 mg/l occurred in one sample, and one sample contained 0.1 mg/l PCBs. Low concentrations of lead (0.03 to 0.11 mg/l), cadmium (0.01 to 0.02 mg/l) and arsenic (0.001 to 0.004 mg/l) were observed, and no cadmium or chromium was detected. Without seeing the full report, it is hard to interpret these results. They seem unusually low, unless the reporting in mg/l indicates that they are values for leaching rather than actual concentrations in the soil.

4. Records in the IDEM files indicate that in addition to the STS study discussed above, the State of Illinois has collected and analyzed soil samples from the Calumet site on at least two occasions. A summary table in the IDEM files that is attributed to the State of Illinois, shows a concentration of 52 ppm of PCB in a soil sample taken 30 feet west of the loading dock on April 15, 1980. This same summary table includes four samples of sludge taken May 22, 1980 from the east central drum disposal area with concentrations of toluene (610 to 4,300 ppm), xylene (1,900 to 8,500 ppm), and PCB (0.2 to 2.2 ppm).

5. EPA took one sample of soil by the loading dock after the fire in April, 1982. The main pollutants identified in this sample were: phenols, 0.135 ppm; cyanide, 9.3 ppm, di-n-butylphthalate, 8.8 ppm, and pyrene, 0.68 ppm (EPA, undated). On June 14, 1983 EPA collected 10 soil samples from the site. The approximate locations of these



samples are shown in Figure 7. All samples were tested for organics, and samples from locations 6, 7, 8, and 9 were also tested for metals. IDEM files contained laboratory results for only metals from sample location 8 (S-33), which are shown in Table 5. Several organics analysis sheets were attached to the inorganics data analysis sheets in the IDEM files and are assumed to be from the same sample location, although they are not clearly labeled. The following organics were measured in this sample (values converted from ppb to ppm): pyrene (0.474 ppm), 1,2-dichloroethane (.003 ppm), trans-1,3-dichloropropene (0.012 ppm), ethylbenzene (7.4 ppm), methylene chloride (3.4 ppm), toluene (0.614 ppm), trichloroethene (0.037 ppm), 2-butanone/methyl ethyl ketone (0.056 ppm), 2-hexanone (0.121 ppm), and o-xylene (26.7 ppm). In January and February 1984 about 1,000 cubic yards of soil and 1,345 tons of sludge and solidified waste was removed from the site and covered with a clay cap as part of the CERCLA immediate removal action. Extensive sampling was undertaken to characterize the wastes that were removed (Bitter, undated). Hydrosience was unable to find the results of these analyses in IDEM files, and consequently has not reviewed them. Figure 6 shows the approximate area of the clay cap, which covers most of the area where soil was removed.

#### Comparison of Soil Laboratory Analyses

Table 5 compares the data from the WAPORA, ISBH and EPA soil samples with the average concentrations of cyanide and heavy metals in the EMS grid and spot samples. The WAPORA and ISBH are adapted from a table contained in a document titled **Proposed Findings of Fact and Recommended Order (Cause No. B-659)** prepared by the Indiana Stream Pollution Control Board. The table in the Stream Pollution Control Board report showed values in parts per billion. The values for the ISBH samples were converted to ppm by dividing by 1000. The WAPORA data make no sense if they are divided by 1000. This generally results in values that are three orders of magnitude below the detection limits for the analytic procedures used by EMS Laboratory (shown in Table 5). When the WAPORA values are entered as ppm rather than ppb values, they are similar to, or somewhat higher than the averages in Hydrosience's grid and spot samples. Both of these lines of evidence lead Hydrosience to conclude that the concentrations reported for the soil samples in the the WAPORA report were mislabeled.

The ISBH soil samples were concentrated in the vicinity of the zone of greatest contamination around the plant and show considerably higher concentrations of lead (generally greater than 10,000 ppm) and chromium (generally greater than 1,000 ppm) than the EMS grid and spot sample averages. However, even the highest value of 22,400 ppm for lead is less than the 38,000 ppm measured at SS9. The ISBH "background" samples merit some further discussion. The on-site samples (5A and 5B), taken May 22, 1979, show above background levels

of cadmium, chromium and lead at both depth increments. This is consistent with the EMS grid sample data that indicates some degree of contamination over the entire site. The off-site background samples (5 and 6, taken September 5, 1979) contains "normal" levels of cadmium, chromium and lead, except that the concentration of lead at 6 inches is well above background (99 ppm vs 15 ppm). Consequently, some amount of soil contamination exists off the site, but at much lower levels than occur on-site.

Figure 6 shows the maximum concentrations of lead and organics in the grid and spot samples, and other soil samples where lead and organics are above background levels and the location is known. Figure 6 also shows the approximate area of contaminated soil removal by the CERCLA clean-up in 1984. It is interesting that the one grid sample (SS8) that lies within this area shows relatively low concentrations of lead (200 ppm) compared to samples outside the soil removal area. The EPA sample, which was taken quite near SS8 prior to the soil removal shows high concentrations of lead (7,570 ppm). The ISEH May 1979 samples 2, 3, and 4 (see Table 5) which had concentrations of lead ranging from 11,600 to 22,400 ppm are presumed to have been located within the soil removal area. If this is true, the CERCLA clean-up succeeded in removing much of the most highly contaminated soil, but not all, as indicated by the high values at I1 (15,121 ppm), I2 (19,896 ppm), and SS9 (38,000 ppm). In addition to the highly contaminated area in the central part of the site, the areas to the south, northwest and east of the clean-up area remain highly contaminated with lead (generally greater than 1,000 ppm). There also appear to be two zones which are highly contaminated with organic constituents: the very southern part of the site (SS6 and SD1) where total organics range from 2,840 to 6,481 ppm, and the area between the pond and the clean-up zone (SS11 and SS9) where total organics range from 1,334 to 6,366 ppm).

#### SUMMARY AND CONCLUSIONS

The following major conclusions seem justified by the soil data reviewed above:

1. Widespread contamination of soil by heavy metals and hazardous organic substances exists throughout the site. All sample locations show some evidence of contamination. A sample is considered contaminated if heavy metals occur in concentrations above normal background levels in northern Indiana, or if organic substances that have been identified as hazardous or potentially hazardous were detected. Lead, cadmium, chromium and cyanide are the most widely occurring inorganic contaminants. Di-n-butyl phthalate, bis(2-ethylhexyl)phthalate, toluene, m-xylene and o-xylene are the most frequently occurring organic contaminants. Methylene chloride and methyl ethyl ketone occurred in more than three-quarters of the

samples, but evidence of contamination of the soil samples in the laboratory prevents any conclusion about how widely they occur at the site.

2. The EPA CERCLA clean-up in 1984 removed much of the most highly contaminated soil from the site. However, high levels lead of contamination (greater than 10,000 ppm) remain in the central part of the site, northeast of the CERCLA clean-up zone. Concentrations of lead generally exceed 1,000 ppm in the the central and southern areas of the site that lie outside the CERCLA clean-up zone.

3. Organic contaminants were detected at all sample locations. The areas of highest concentrations of total organics are in the very southern part of the site (6,481 ppm at SD1) and the east central part (6,366 ppm at SS11). Concentrations of total organics also exceed 1,000 ppm in the northcentral area (SS9 and SD3).

4. In general, metals contamination decreases with depth, although there are a few locations where lead (SS4 and SS7) and cadmium (SS4) increased with depth. On the other hand, levels of total organics increased with depth at the same number of locations as they decreased with depth, indicating that migration of organics deeper into the soil profile is common. The average concentrations of organic constituents in samples from depressional areas are generally higher than for the same constituents in the grid samples, indicating that surface runoff has tended to concentrate organics in depressional areas. This does not appear to be a significant process for heavy metals.

5. Levels of soil contamination can change greatly in relatively small distances. For example, SS9 contains a the highest concentration of lead that was found on the site (38,000 ppm) and 1,334 ppm total organics. SD1, which is nearby, contained 380 ppm lead, and 117 ppm total organics.

6. Soil sample data from other sources (with the adjustment to the WAPORA data discussed above) are generally consistent with this study with respect to levels of inorganic contaminants. Data on organics from other sources are less extensive, but are also generally consistent with this study. A few organic contaminants have been identified in samples from other sources that were not found in this study. PCBs in concentrations ranging from 0.2 to 52 ppm were identified in five soil samples taken by the State of Illinois in 1980. The absence of PCBs in any of Hydrosience's 38 soil samples indicates that PCBs, if still present on the site, are very localized. EPA sample 10, taken in 1983, identified low concentrations of two organic contaminants that were not found in any of Hydrosience's soil samples: trans-1,3-dichloropropene (0.012 ppm), and 2-hexanone (0.121 ppm).

Table 1. Calumet Container Site, Summary of Soil Laboratory Analysis Results (Grid)  
(Heavy metals above background and detected organics).

EMS Parameter ID#	Units	Background		Samples Exceeding Background				
		U.S.	No. IN	No.	Average	Maximum	Minimum	% Total
1 Cyanide, total (CN)	mg/kg (ppm)			21	13.8	110	0.5	80.8%
2 Sulfide	mg/kg (ppm)			0	0	0	0	0.0%
3 PH				26	7.6	8	7.1	100.0%
4 Arsenic	mg/kg (ppm)	5.8	6.3	5	34.9	140	7.3	19.2%
5 Barium	mg/kg (ppm)	430	500	5	724	1,200	530	19.2%
6 Cadmium	mg/kg (ppm)	1		17	7.6	20	1.5	65.4%
7 Chromium	mg/kg (ppm)	37	30	14	236	590	34	53.8%
8 Lead	mg/kg (ppm)	16	15	23	2,470	38,000	25	88.5%
9 Mercury	mg/kg (ppm)	0.96	>1.5	1	2.1	2	2.1	3.8%
10 Nickel	mg/kg (ppm)	14	15	10	33	75	16	38.5%
11 Selenium	mg/kg (ppm)	0.31	0.67	0	0	0	0	0.0%
12.5 Phenols	mg/kg (ppm)			7	5.6	30	0.2	26.9%
16 Anthracene	mg/kg (ppm)			1	1	1	1	3.8%
18 Benz(a)anthracene (est)	mg/kg (ppm)			1	1	1	1	3.8%
20 Benzo(b)fluoranthene (est)	mg/kg (ppm)			2	1	1	1	7.7%
24 Butyl benzyl phthalate	mg/kg (ppm)			1	2	2	2	3.8%
28 Bis(2-ethylhexyl)phthalate	mg/kg (ppm)			14	91	520	1	53.8%
34 Chrysene (est)	mg/kg (ppm)			1	1	1	1	3.8%
42 Dimethylphthalate (est)	mg/kg (ppm)			1	1	1	1	3.8%
43 Di-n-butyl phthalate	mg/kg (ppm)			21	68	610	1	80.8%
47 Di-n-octylphthalate	mg/kg (ppm)			8	168	450	13	30.8%
49 Fluoranthene (est)	mg/kg (ppm)			5	2	6	1	19.2%
50 Fluorene (est)	mg/kg (ppm)			1	1	1	1	3.8%
56 Isophorone (est)	mg/kg (ppm)			3	3	6	1	11.5%
57 2-Methylnaphthalene (est)	mg/kg (ppm)			5	4	8	1	19.2%
58 Napthalene	mg/kg (ppm)			6	10	51	1	23.1%
65 Phenanthrene (est)	mg/kg (ppm)			5	2	5	1	19.2%
67 Pyrene (est)	mg/kg (ppm)			4	1	1	1	15.4%
115 Benzene U	mg/kg (ppm)			1	0.4	0.4	0.4	3.8%
119 Carbon disulfide	mg/kg (ppm)			1	16	16	16	3.8%
129 1,1-Dichloroethane U	mg/kg (ppm)			2	1	1	0.4	7.7%
133 Ethylbenzene U	mg/kg (ppm)			11	43	270	0	42.3%
134 Fluorotrichloromethane	mg/kg (ppm)			1	1	1	1	3.8%
136 Methylene chloride U	mg/kg (ppm)			23	2	32	1	88.5%
138 Methyl ethyl ketone U	mg/kg (ppm)			20	6	9	4	76.9%
140 Styrene	mg/kg (ppm)			1	1	1	1	3.8%
142 Tetrachloroethene	mg/kg (ppm)			1	1	1	1	3.8%
144 Toluene	mg/kg (ppm)			15	243	3,300	0	57.7%
149 Trichloroethene	mg/kg (ppm)			2	0	0	0	7.7%
152 m-xylene	mg/kg (ppm)			16	217	1,800	1	61.5%
153 o-xylene	mg/kg (ppm)			15	146	1,100	0	57.7%

Table 2. Calumet Container Site, Summary of Soil Laboratory Analysis Results (Spot)  
(Heavy metals above background and detected organics).

EMS Parameter ID#	Units	Background		Samples Exceeding Background				
		U.S.	No. IN	No.	Average	Maximum	Minimum	% Total
1 Cyanide, total (CN)	mg/kg (ppm)			7	28	90	1	58.3%
2 Sulfide	mg/kg (ppm)			2	1.8	2	1.5	16.7%
3 PH				12	7.7	9	7	100.0%
4 Arsenic	mg/kg (ppm)	5.8	6.3	5	39.8	130	10	41.7%
5 Barium	mg/kg (ppm)	430	500	4	990	1,600	730	33.3%
6 Cadmium	mg/kg (ppm)	1		9	8.6	16	4	75.0%
7 Chromium	mg/kg (ppm)	37	30	11	244	800	19	91.7%
8 Lead	mg/kg (ppm)	16	15	11	1,089	2,900	58	91.7%
9 Mercury	mg/kg (ppm)	0.96	>1.5	4	2	3	1.5	33.3%
10 Nickel	mg/kg (ppm)	14	15	7	34	49	21	58.3%
11 Selenium	mg/kg (ppm)	0.31	0.67	4	4	5	3.1	33.3%
12.5 Phenols	mg/kg (ppm)			4	2.3	6	0.2	33.3%
16 Anthracene	mg/kg (ppm)			0	0	0	0	0.0%
18 Benz(a)anthracene (est)	mg/kg (ppm)			0	0	0	0	0.0%
20 Benzo(b)fluoranthene (est)	mg/kg (ppm)			0	0	0	0	0.0%
24 Butyl benzyl phthalate	mg/kg (ppm)			0	0	0	0	0.0%
28 Bis(2-ethylhexyl)phthalate	mg/kg (ppm)			9	267	2,000	2	75.0%
34 Chrysene (est)	mg/kg (ppm)			0	0	0	0	0.0%
42 Dimethylphthalate (est)	mg/kg (ppm)			0	0	0	0	0.0%
43 Di-n-butyl phthalate	mg/kg (ppm)			6	168	970	1	50.0%
47 Di-n-octylphthalate	mg/kg (ppm)			6	41	60	23	50.0%
49 Fluoranthene (est)	mg/kg (ppm)			1	1	1	1	8.3%
50 Fluorene (est)	mg/kg (ppm)			0	0	0	0	0.0%
56 Isophorone (est)	mg/kg (ppm)			1	2	2	2	8.3%
57 2-Methylnaphthalene (est)	mg/kg (ppm)			2	17	27	27	16.7%
58 Napthalene	mg/kg (ppm)			4	24	69	1	33.3%
65 Phenanthrene (est)	mg/kg (ppm)			0	0	0	0	0.0%
67 Pyrene (est)	mg/kg (ppm)			1	1	1	1	8.3%
115 Benzene	mg/kg (ppm)			0	0	0	0	0.0%
119 Carbon disulfide	mg/kg (ppm)			0	0	0	0	0.0%
129 1,1-Dichloroethane	mg/kg (ppm)			0	0	0	0	0.0%
133 Ethylbenzene	mg/kg (ppm)			7	128	680	0	58.3%
134 Fluorotrichloromethane	mg/kg (ppm)			0	0	0	0	0.0%
136 Methylene chloride	mg/kg (ppm)			11	36	350	1	91.7%
138 Methyl ethyl ketone	mg/kg (ppm)			9	7	8	5	75.0%
140 Styrene	mg/kg (ppm)			0	0	0	0	0.0%
142 Tetrachloroethene	mg/kg (ppm)			0	0	0	0	0.0%
144 Toluene	mg/kg (ppm)			8	278	1,700	0	66.7%
149 Trichloroethene	mg/kg (ppm)			0	0	0	0	0.0%
152 m-xylene	mg/kg (ppm)			9	298	2,100	1	75.0%
153 o-xylene	mg/kg (ppm)			10	169	1,300	0	83.3%

Table 3. Contaminants by Sample Percentage Class, Calumet Site (Grid Samples).

0-24.9%	25-49.9%	50-74.9%	75-100%
HEAVY METALS			
Arsenic	Nickel	Cadmium	Lead
Barium		Chromium	Cyanide
Mercury			
ORGANICS			
Anthracene	Phenols	Toluene	Di-n-butyl phthalate
Banz(a)anthracene	Di-n-octyl-	m-xylene	Methylene chloride *
Benzo(b)fluoranthene	phthalate	o-xylene	Methyl ethyl ketone *
Butyl benzyl phthalate	Ethylbenzene	Bis(2-ethylhexyl)-	
Chrysene		phthalate	
Dimethylphthalate			
Fluoranthene			
Fluorene			
Isophorone			
2-Methylnaphthalene			
Napthalene			
Phenanthrene			
Pyrene			
Benzene			
Carbon disulfide			
1,1-Dicholorethane			
Flurotrichloromethane			
Styrene			
Tetrachloroethene			
Trichloroetene			

\* May be less widespread than indicated here, due to evidence of contamination of soil samples in the laboratory by these consituents.

Table 4. Calumet Site, Changes in Selected Contaminants with Depth.

Concentrations	Increase w/depth	Decrease w/depth	Little Change
Grid samples (total organics)	SS4, SS6, SS7 SS8, SS11	SS1, SS2, SS3 SS5, SS9, SS10	SS12
Spot samples (total organics)	SD1, SD2	SD3	
Lead	SS4, SS7	SS1, SS2, SS3 SS5, SS6, SS8 SS9, SS10, SS11 SS12, SD2, SD3	SD1
Cadmium	SS4	SS2, SS3, SS5 SS6, SS7, SS8 SS9, SS10	SS11

SS = Grid (Systematic) Sample

SD = Spot (Depressional) Sample

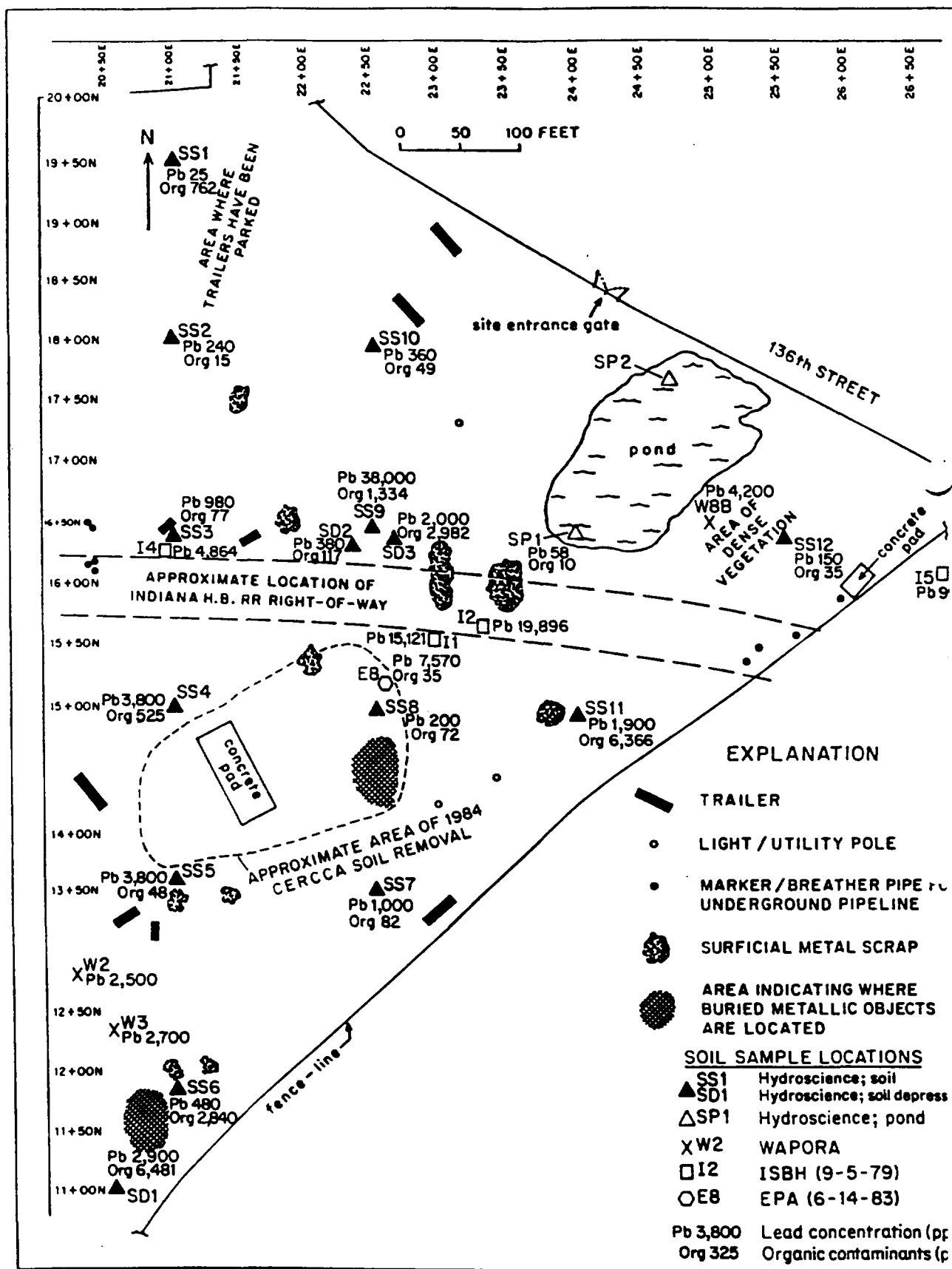


Figure 6. Maximum concentrations of lead and total organics.



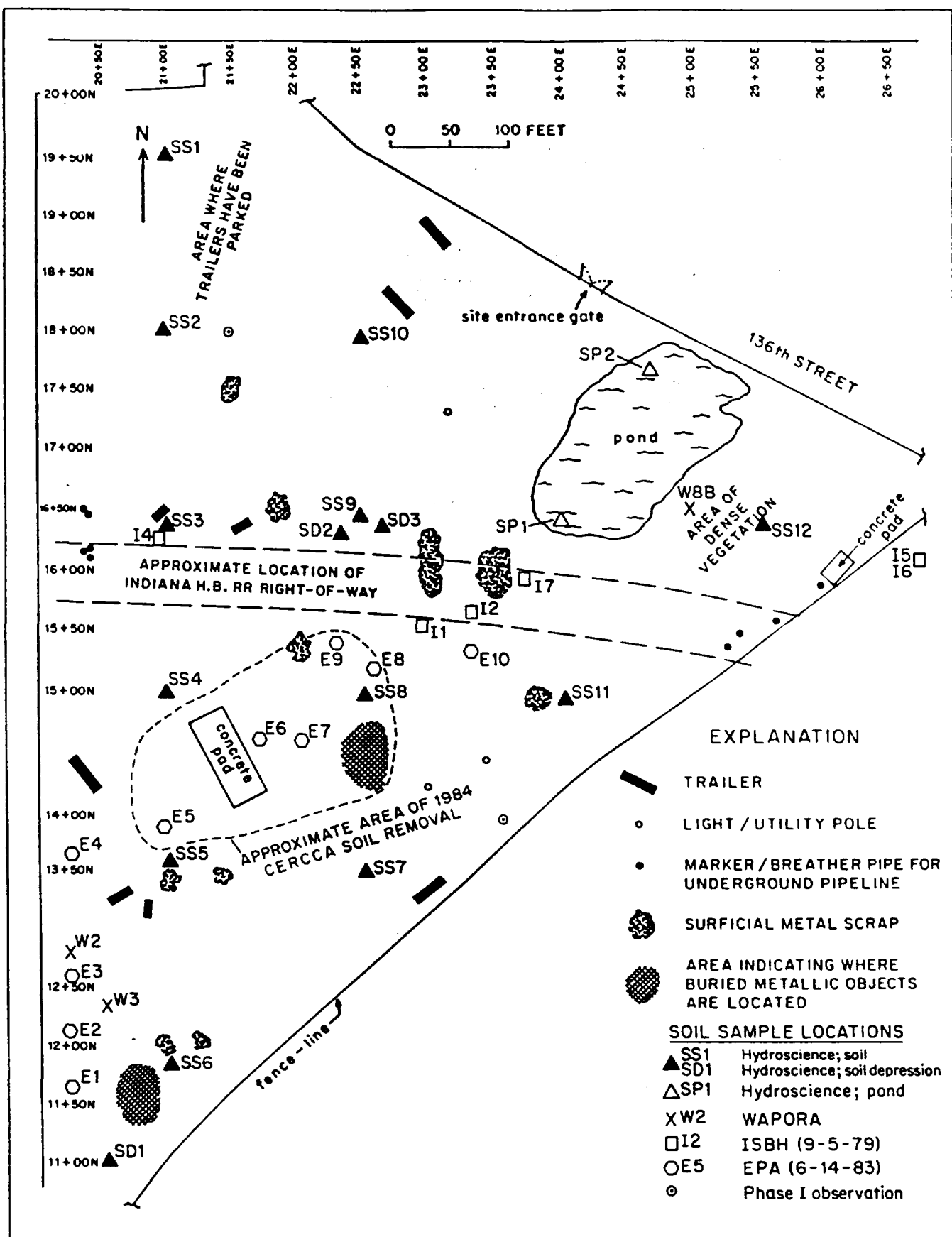


Figure 7. Location of WAPORA, ISEH, and EPA soil samples.

Table 5. Comparison of Heavy Metal Concentrations in EMS Soil Samples With Other Soil Sampling Results.

	Element								
	Cu ppm	As ppm	Ba ppm	Cd ppm	Cr ppm	Pb ppm	Hg ppm	Ni ppm	Se ppm
EMS (10/87)									
Grid (average)	13.8	34.9	724	7.6	236	2,470	2.1	33	0
Spot (average)	28.0	39.8	990	8.6	244	1,089	2.0	34	4.0
WAPORA (5/1/79) (entered as ppm rather than ppb)*									
2 Soil (15' west of pit)	4.1	7.5	77	2.9	365	2,500	0.002	17	4.7
3 Soil (30' S.E of pit)	15.3	15.5	<5	84	2100	2,700	0.014	813	5.2
8B Soil (15' S.E of pond)	0.25	11.6	56	<1.0	30	4,200	<.0002	25	<.1
Detection Limits (EMS Laboratory)	0.25	1.0	5.0	0.5	1.3	5.0	0.13	1.8	1.0
ISBH (5/22/79)*									
1 Soil N.W. of Bldg.	--	--	--	3.2	152	3.7	--	--	--
2 Soil/Sludge (conveyor end)	--	--	--	38.8	3,980	22,400	--	--	--
3 Soil/Sludge (conveyor end)	--	--	--	7.6	3,940	14,600	--	--	--
4 Soil/Sludge (conveyor end)	--	--	--	66.7	2,150	11,600	--	--	--
5A Soil (27' S. of trailer 3-10")	--	--	--	0.4	40	93	--	--	--
5A Soil (27' S. of trailer 10-14")	--	--	--	2	203	163	--	--	--
ISBH (9/5/79)*									
1 Sludge/soil 12' W. excav.	--	--	--	6.4	2,080	15,121	--	--	--
2 Sludge/soil W. edge excav.	--	--	--	25.9	2,916	19,896	--	--	--
4 Soil, N. of plant	--	--	--	32.0	5,638	4,864	--	--	--
5 Soil (6" off-site)	--	--	--	0.6	24.4	99	--	--	--
6 Soil (15" off-site)	--	--	--	ND	6.4	5.9	--	--	--
7 Soil from excavation	--	--	--	ND	6.3	4.4	--	--	--
EPA (6/14/83)									
8 NE of plant	ND	<0.5	424	32	917	7,570	1.1	195	<0.1
Northern Indiana Background									
	--	6.3	500	1	30	15	>1.5	15	0.67

\* Adapted from Indiana Stream Pollution Control Board, Proposed Findings of Fact and Recommended Order (Cause No. B-659, 1980).

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APPENDIX A  
Field Data Sheets

## FIELD DATA SHEETS

The following sheets contain observations made in the field when soil samples were collected in May and again in October, because the laboratory analysis of the May samples did not meet QA/QC standards. The soil profile descriptions and other field observations for the May sampling retained in the Field Data Sheets because they include useful information on depth to water and measurements of volatiles with an HNU meter independently of the soil samples that were collected. In May, Russell Boulding made the observations and determinations of sampling depth; Roy Funkhouser, unless otherwise noted collected the soil samples; Noel Krothe took field notes; and Mike Wirt measured levels of volatiles and made determinations when respirators were required during sampling. During the October resampling Russell Boulding made the observations, Roy Funkhouser collected the soil samples, and Swapan Ghosh took field notes and measure levels of volatiles. The field notes for the second set of samples are indicates by a "II" preceding the location number. These notes are the ones that should be refered to for field observations related to the soil laboratory analysis results. During the second sampling, the decision to use a respirator during sampling was based on review of laboratory data from the first set of samples and readings from a HNU meter at the new sample location.

### Abbreviations:

RB = Russell Boulding

RF = Roy Funkhouser

NK = Noel Krothe

MW = Mike Wirt

SG = Swapan Ghosh

fsl = fine sandy loam

SS = Systematic (grid) soil sample location.

SD = Depressional (spot) soil sample location.

SP = Pond sediment sample location.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS1; IISS1

Date: 5/13/87; 10/15/87  
Time: 10:45 AM; 10:00 AM

Grid Location Point: 19 50 N, 21 00 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Depressional area with charred timbers at surface. Sample location 24" south of grid point. Second sample 1' south and 3' west of previous location.

Profile Description:

Depth Description

0-1" Dark colored carbonaceous material  
1-6" Well-drained fsl  
6-24" Gravel (slag?) in matrix of fsl, seasonally saturated.  
24-26" Saturated fsl

II: 0-1" Dark colored carbonaceous material  
1-3" Well-drained fsl  
3-18" Gravel (slag?) in matrix of fsl, seasonally saturated.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS1-1	0-6"	16 oz	IISS1-1	0-6"	32 oz
SS1-2	20-26"	16 oz	IISS1-2	18-20"	32 oz

Comments:

Decontaminated equipment by usual procedures before taking first soil sample. No measurements taken for volatiles.

II: Sampling depth limited by the presence of concrete slabs. No measurable volatiles.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS2; IISS2

Date: 5/13/87; 10/15/87  
Time: 11:10 AM: 10:55 AM

Grid Location Point: 18 00 N, 21 00 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Hummocky grass-covered ground. Samples taken 5' south of stake.  
Second samples taken 3' east of first sample location.

Profile Description:

Depth Description

0-12" Dark, fsl, slag and wood fragments.  
12-24" Mixed topsoil and gray-mottled subsoil with some slag.  
24" Estimated permanent water table.

II: Same as first sample location.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS2-1	0-6"	16 oz	IISS2-1	0-6"	32 oz
SS2-2	18-24"	16 oz	IISS2-2	18-24"	32 oz

Comments:

Volatiles at background level at both sample locations.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS3; IISS3

Date: 5/13/87; 10/15/87  
Time: 11:40 AM; 11:30 AM

Grid Location Point: 16 50 N, 21 00 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Near abandoned tanker, wood and metal rubble on surface. Samples taken 6' northeast of stake. Second sample taken 4' northeast of original sample location.

Profile Description:

Depth Description

0-6" Dark, fsl, mixed with gravel.  
6-24" Moderately well drained, light colored fsl.  
24-26" Gray-mottled fsl.  
26-28" Saturated, dark colored carbonaceous material.

II: Similar to first location, small amount of bituminous sludge at 26".

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS3-1	0-6"	16 oz	IISS3-1	0-6"	32 oz
SS3-2	22-28"	16 oz	IISS3-2	22-28"	32 oz

Comments:

Dark-colored material below water table included in SS3-2. Volatiles in this sample were barely above background level. HNU reading at second sample location 10 meter units. Sampling equipment decontamination was done with warm water and acetone due to pump malfunction. All subsequent equipment cleaning was done with hot water from pressure washer. The bucket augur and sampling spoons were also cleaned with acetone each time.



Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS4; IISS4

Date: 5/13/87; 10/15/87

Time: 12:00 noon; 12:05 PM

Grid Location Point: 15 00 N, 21 00 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Depression with sparse weeds 10' east of stake and 10' north of clay cap. Second sample location 8' east of stake and 10' north of clay cap.

Profile Description:

Depth Description

0-6" Dark, fsl (topsoil fill).

6-8" Thick blackish-gray sludge w/ speckles of yellow, green and purple.

8" Greenish liquid from decomposed can.

8-18" Black and gray fsl, flecks of red, some sludge.

18" Metal, possibly a drum.

II: 0-4" Dark, fsl (topsoil fill), blue and yellow pigments.

4-18" Fsl, streaks of bituminous sludge with purple and yellow colors visible.

18-20" Dark fsl, yellow and green flecks.

20" Buried metal prevented sampling deeper.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS4-1	6-8"	16 oz	IISS4-1	0-6"	32 oz
SS4-2	12-18"	16 oz	IISS4-2	14-20"	32 oz

Comments:

SS4-1 taken at 6-8" to obtain concentrated sample of sludge. 10 ppm volatiles measured at 6", 110 ppm measured at 8". No measurable volatiles at 0-6", 15-20 meter units at 14-20" at IISS4. Respirator used by RF while sampling.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS5; IISS5

Date: 5/13/87; 10/15/87

Time: 2:25 PM; 2:20 PM

Grid Location Point: 13 50 N, 21 00 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Clay cap area, near old building (northwest side). Scattered wood discolored from oil. Depressional area 6' southeast of stake. IISS5 9' south and 9' east of stake. Off the edge of the clay cap.

Profile Description:

Depth Description

0-2" Clay cap.  
2-6" Dark, fsl, metal fragments and gravel.  
6-7" Tar sludge, red, yellow, pink, gray band 1/2" thick.  
7-14" Mixed fill.  
14-24" Dark, fsl.  
24-30" Dark, fsl, gray mottling.

II: 0-8" Dark, fsl, metal fragments and gravel.  
8-18" Tar sludge, greenish flecks.  
18" Too rocky to dig deeper.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS5-1	2-8"	16 oz	IISS5-1	0-6"	32 oz
SS5-2	24-30"	16 oz	IISS5-2	12-18"	32 oz

Comments:

Volatiles at 30" at background level (5ppm). Permanent water table may be a little deeper than 30". No measurable volatiles at IISS5. Soil was too rocky to dig deeper than 18" at IISS5.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS6; IISS6

Date: 5/13/87; 10/15/87

Time: 3:00 PM; 2:55 PM

Grid Location Point: 12 00 N, 21 00 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Slight depression, metal and wood rubble on surface. Former drum storage area. Samples taken 4' south of stake. IISS6 taken 2' south of stake.

Profile Description:

Depth Description

0-6" Irregular sludge lenses; blue, red, green flecks.  
Matrix varigated fsl (gray and black).  
6-12" Varigated fsl.  
12-30" Bituminous fsl.  
30" Water table.

II: 0-9" Irregular sludge lenses; blue, red, green flecks.  
Matrix light fsl.  
9-30" Bituminous fsl.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS6-1	0-6"	16 oz	IISS6-1	0-6"	32 oz
SS6-2	24-30"	16 oz	IISS6-2	24-30"	32 oz

Comments:

Volatiles measurements ranged from 17 (near surface) to 120 ppm (12-18"). Readings of 110 ppm were obtained on auger, and 90 ppm at 30". At IISS6 HNU readings were as follows: 0-6" 5 units, 12" 40 units, 24" 200 units. RF used respirator while sampling.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS7; IISS7

Date: 5/13/87; 10/15/87

Time: 3:40 PM; 3:40PM

Grid Location Point: 13 50 N, 22 50 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Depressional area, 5' southeast of stake. Gravel at surface.  
IISS7 located 5' east of stake.

Profile Description:

Depth Description

0-6" Gravel, matrix fsl, blue, green and red flecks.  
6-12" Same.  
12" Water table.

0-6" Gravel, matrix fsl.  
6-12" Gravel, fsl matrix darker.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS7-1	0-6"	16 oz	IISS7-1	0-6"	32 oz
SS7-2	6-12"	16 oz	IISS7-2	24-30"	32 oz

Comments:

Volatiles at background levels. Volatiles a little above background (5-7 units) at IISS7. Respirator used by RF during sampling.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS8; IISS8

Date: 5/13/87; 10/15/87

Time: 4:05 PM; 4:15 PM

Grid Location Point: 15 00 N, 22 50 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Depressional area 2' south of stake. IISS8 located 6' south of stake in depressional area.

Profile Description:

Depth Description

0-6" Dark fsl with lenses of clay or sludge.  
6-12" Mixture of fsl and clay stringers.  
12-18" Fine sandy loam.  
18-20" Saturated fsl.

II: 0-4" Dark fsl.  
4-10" Mixture of fsl and clay stringers.  
10-12" Gray sludge.  
12-18" Bituminous fsl.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS8-1	0-6"	16 oz	IISS8-1	0-6"	32 oz
SS8-2	14-20"	16 oz	IISS8-2	12-18"	32 oz

Comments:

Volatiles at background levels. Water table at 18". Volatiles at IISS8 were 20 units at 12" and 35-40 units at 18". Respirator was used by RF during sampling.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS9; IISS9 and IISS13 Date: 5/13/87; 10/15/87  
Time: 4:30 PM; 4:45 PM

Grid Location Point: 16 50 N, 22 50 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

High spot between two depressional areas (SD2 and SD3). IISS9 located 1' west of stake.

Profile Description:

Depth Description

0-10" Multi-colored, gravelly fsl. Sludge on hole's north side.

10-18" Fine sandy loam.

18-32" Silt loam.

32-38" Saturated, bituminous fsl.

II: 0-3" Gravelly fsl.

3-12" Multi-colored (green, orange, purple, red, blue) tarry sludge.

12-18" Gray fsl.

18-24" Gray fsl mixed with black sludge.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS9-1	0-6"	16 oz	IISS9-1	0-6"	32 oz
SS9-2	26-32"	16 oz	IISS9-2	18-24"	32 oz
			IISS13-1	0-6"	32 oz
			IISS13-2	18-24"	32 oz

Comments:

Volatiles near surface were from 60-70 ppm. Water table was estimated in the field to be at 32", but this is 1 foot deeper than at SS3 150' to the east and the only depth that does not fit into the approximate potentiometric surface indicated by all the other samples. IISS9 and IISS13 are replica samples. Volatiles at second location were 40-50 units near surface and 5 units at 18". Respirator used by RF during sampling.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS10; IISS10

Date: 5/13/87; 10/16/87

Time: 5:10 PM; 9:05 AM

Grid Location Point: 18 00 N, 22 50 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Higher ground, heavy vegetation with aspen seedlings. Sample location 2' north of stake. IISS10 2' south of stake.

Profile Description:

Depth Description

0-9" Dark, fsl with water worn gravel and wood fragments.  
9-23" Brown, fsl.  
23-24" Saturated.

II: Same as above.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS10-1	0-6"	16 oz	IISS10-1	0-6"	32 oz
SS10-2	18-24"	16 oz	IISS10-2	18-24"	32 oz

Comments:

Volatiles at background levels. No measurable volatiles at IISS10. Tarry material on auger from sampling at IISS11 scrubbed with acetone and brush.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS11; IISS11

Date: 5/14/87; 10/15/87  
Time: 8:40 AM; 5:20 PM

Grid Location Point: 15 00 N, 24 00 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Hummocky fill with metal, glass rubble at surface. Sample location 1' west of stake. IISS11 located 2' east of stake.

Profile Description:

Depth Description

0-2" Fine sandy loam.

2-6" Black sludge with green and yellow flecks mixed with fsl.

6-18" All sludge with red, yellow, orange, green and purple flecks.

18" Water table.

II: 0-3" Dark fsl.

3-6" Dense black sludge with green, yellow, orange, purple flecks mixed with fsl.

6-12" Fine sandy loam.

12-18" Very tarry, sticky sludge.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SS11-1	0-6"	16 oz	IISS11-1	0-6"	32 oz
SS11-2	12-18"	16 oz	IISS11-2	12-18"	32 oz

Comments:

Volatiles slightly above background levels at SS11-1. Volatiles exceeded 100 ppm at 6-12". Respirator was used by RF to collect sample SS11-2. Volatiles at IISS11 were as follows: 0-6" 5 units, 6-12" zero, 12-18" 50 units. Respirator was used by RF for sampling. Tarry material from previous IISS9 sample had to be scrubbed with brush and acetone to clean augur.



Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SS12 & SS13; IISS12 Date: 5/14/87; 10/16/87  
Time: 9:55 AM; 9:30AM

Grid Location Point: 16 50 N, 25 50 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

On hummock, 5' east of stake. Open water 25' to west, marsh 15' to south. Dense sumac and shrubs. Many roots at surface. IISS12 located 3' northwest of stake.

Profile Description:

Depth Description

0-6" Dark, fsl with gravel.  
6-10" Fsl with grayish clay flecks. Not as dark and more variegated in color than surface horizon.  
10-12" Saturated.

II: Same as above except that water table was below 12"

Samples:

ID No.	Depth Amount	ID No.	Depth Amount
SS12-1	0-6" 16 oz	IISS12-1	0-6" 32 oz
SS12-2	6-12" 16 oz	IISS12-2	6-12" 32 oz
SS13-1	0-6" 16 oz		
SS13-2	6-12" 16 oz		

Comments:

Equipment cleaned with acetone prior to sampling to remove sludge from SS11. Replica samples were taken by mixing the soil in the two depth increments and placing equal amounts in two sample jars. Replica sample taken at IISS9 to check more contaminated site. No measureable volatiles.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SD1; IISD1

Date: 5/14/87; 10/16/87  
Time: 10:25 AM; 11:35 AM

Grid Location Point: 11 00 N, 20 50 E

Personnel Present: RB, RF, NK, MW; RB, RF, SG

Site Description:

Depressional area 15' west of stake. Surface still moist from heavy rain two days before. IISD1 located 9' west and 6' south of stake.

Profile Description:

Depth Description

0-3" Light colored sandy clay loam.  
3-6" Dense sludge with pink, yellow flecks.  
6-12" Sludge mixed with fsl.  
12-24" Sludge content higher, bituminous looking fsl.

II 0-6" Dark fsl with lenses of dense sludge with flecks of pink, yellow and purple.  
6-12" Bituminous fsl.  
12-18" Gray sparkling aggregates disseminated in black bituminous fsl.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SD1-1	0-6"	16 oz	IISD1-1	0-6"	32 oz
SD1-2	9-15"	16 oz	IISD1-2	9-15"	32 oz
SD1-3	18-24"	16 oz	IISD1-3	18-24"	32 oz

Comments:

40 ppm volatiles at 3". Readings on volatiles ranged from 40-120 in the 6-12" depth increment. Sampling was first attempted 3' to south, but what appeared to be a barrel at was found at 2". Respirator was used by RF to collect samples. SD1-3 was bituminous fsl with red, blue and green flecks. IISD1 volatile readings: 3-6" 20 units, 9" 30-40 units, 9-12" 100 units, 18" 150 units. Respirator used by RF to collect samples. Note also that 180 units were measured in a soil corehole at the grid point during the Phase I soil investigation on May 12, 1987.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SD2; IISD2

Date: 5/14/87; 10/16/87

Time: 1:00 PM; 10:00 AM

Grid Location Point: 16 50 N, 22 50 E

Personnel Present: RB, RF, NK; RB, RF, SG

Site Description:

Large wet depression which had had standing water during the two previous days. Blue stained gravel covers surface to the north. Sample location 15' south and 6' west of stake. IISD2 located 14' south and 10' west of stake.

Profile Description:

Depth Description

0-6" Fine sandy loam mixed with gravel.

6-22" Fsl, occasional heavy two chroma mottling.  
Soil still saturated below 6".

II: 0-6" Fine sandy loam mixed with gravel, lense and pockets of black sludge.

6-14" Fsl, occasional heavy two chroma mottling.

14-22" Gray and black mottled fsl.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SD2-1	0-6"	16 oz	IISD2-1	0-6"	32 oz
SD2-2	8-14"	16 oz	IISD2-2	8-14"	32 oz
SD2-3	16-22"	16 oz	IISD2-3	16-22"	32 oz

Comments:

Equipment cleaned with acetone to remove sludge from SD1 prior to sampling. Soil was saturated below 6", due to the heavy rains two days previously. The permanent water table is probably deeper. No comments for IISD2.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SD3; IISD3 and IISD4

Date: 5/14/87; 10/16/87

Time: 1:25 PM; 10:30 AM

Grid Location Point: 16 50 N, 22 50 E

Personnel Present: RB, RF, NK; RB, RF, SG

Site Description:

Large depression which had dried one day earlier than SD2.  
Sample location 45' east and 1' south of stake. IISD3 located 46' east and 1' north of the stake.

Profile Description:

Depth Description

0-6" Dark, fsl with lenses of silty clay loam.  
6-12" Darker colored, primarily silty clay.  
12-28 Loam, soil saturated below 9".

II: 0-3" Dark, fsl with lenses of silty clay loam.  
3-6" Light fsl.  
6-15" Dark gray fsl.  
15-18" Sticky sludge.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SD3-1	0-6"	16 oz	IISD3-1	0-6"	32 oz
SD3-2	6-12"	16 oz	IISD3-2	6-12"	32 oz
SD3-3	12-18"	16 oz	IISD3-3	12-18"	32 oz
			IISD4-1	0-6"	32 oz
			IISD4-2	6-12"	32 oz

Comments:

A sudden thunderstorm prevented collection a replica samples at this location. As with SD2, the permanent water table is presumed to be somewhat lower than the depth of observed saturation. Replica samples IISD4-1 and IISD4-2 taken for the first two depth increments. No volatiles measured.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SP1; IISP1

Date: 5/14/87; 10/16/87

Time: 2:15 PM; 12:15 PM

Grid Location Point: 16 00 N, 20 00 E

Personnel Present: RB, RF; RF, SG

Site Description:

Edge of pond 35' north and 25' east of stake. Sample taken about 8' north of water's edge from a depth of about 30". IISP1 taken from water depth of 40", 5' north of water line.

Profile Description:

Depth Description

0-30" Water  
30" Black and gray fsl.

II: 0-48" Water  
48" Black and gray fsl, organic rich.

Samples:

ID No.	Depth	Amount	ID No.	Depth	Amount
SP-1	30"	16 oz	IISP-1	40"	32 oz

Comments:

Sample taken by RF with dredge sampler as a scoop. Several scoops were required to fill the sample bottle. Sample taken by RF with stainless steel scoop attached to a rod.

Calumet Containers Soil Sampling Field Data Sheet

Sample Id. Number: SP2

Date: 5/14/87

Time: 2:30 PM

Grid Location Point: 18 00 N, 24 50 E

Personnel Present: RB, NK

Site Description:

12' south to water's edge and 8' further south to sample point.

Profile Description:

Depth	Description
0-30"	Water
30"	Black and gray fsl.

Samples:

ID No.	Depth	Amount
SP-2	30"	16 oz

Comments:

Sample taken by RB with bucket auger. This proved to be much easier than using the dredge. Note: this sample location was not resampled. A second sediment sample was not taken in October because Mike Wirt (IDEM) preferred a sample from the middle, rather than the edge of the pond. It was decided that this sample would be taken at the same time as the surface water samples.

APPENDIX B

Individual Soil Analysis Results

Table B.1 Calumet Container Site, Individual Soil Analysis Results (Grid).

EMS Parameter ID#	Units	SS1-1	SS1-2	SS2-1	SS2-2	SS3-1	SS3-2	SS4-1	SS4-2
1 Cyanide, total (CN)	mg/kg (ppm)			0.75	1.25	3.75	0.75	5.5	1
2 Sulfide	mg/kg (ppm)								
3 PH		7.4	7.5	7.1	7.3	7.4	7.4	7.3	7.1
4 Arsenic	mg/kg (ppm)							11	7.1
5 Barium	mg/kg (ppm)								
6 Cadmium	mg/kg (ppm)			2.3		12		3.3	4.1
7 Chromium	mg/kg (ppm)					310		170	59
8 Lead	mg/kg (ppm)	25		240	25	980		850	3,800
9 Mercury	mg/kg (ppm)								
10 Nickel	mg/kg (ppm)					17			2
11 Selenium	mg/kg (ppm)								
12.5 Phenols	mg/kg (ppm)					0.3			0.1
16 Anthracene	mg/kg (ppm)								
18 Benz(a)anthracene (est)	mg/kg (ppm)								
20 Benzo(b)fluoranthene (est)	mg/kg (ppm)								
24 Butyl benzyl phthalate	mg/kg (ppm)								
28 Bis(2-ethylhexyl)phthalate	mg/kg (ppm)	380		1.4		20		3.0	
34 Chrysene (est)	mg/kg (ppm)								
42 Dimethylphthalate (est)	mg/kg (ppm)								
43 Di-n-butyl phthalate	mg/kg (ppm)	43	1.3	4.6	1.1	2.7			19
47 Di-n-octylphthalate	mg/kg (ppm)	330				38			4
49 Fluoranthene (est)	mg/kg (ppm)			1.1					
50 Fluorene (est)	mg/kg (ppm)								
56 Isophorone (est)	mg/kg (ppm)					6.2			
57 2-Methylnaphthalene (est)	mg/kg (ppm)								
58 Naphthalene	mg/kg (ppm)								
65 Phenanthrene (est)	mg/kg (ppm)								
67 Pyrene (est)	mg/kg (ppm)			0.94					
115 Benzene	mg/kg (ppm)								
119 Carbon disulfide	mg/kg (ppm)								
129 1,1-Dichloroethane	mg/kg (ppm)								
133 Ethylbenzene	mg/kg (ppm)								2
134 Fluorotrichloromethane	mg/kg (ppm)								
136 Methylene chloride	mg/kg (ppm)	0.88	1.1	0.88	0.94	0.85	0.90	0.84	0.1
138 Methyl ethyl ketone	mg/kg (ppm)	8.6	6.4	6.4	5.4	6.1	5.6	6.2	3
140 Styrene	mg/kg (ppm)								
142 Tetrachloroethene	mg/kg (ppm)								
144 Toluene	mg/kg (ppm)		0.39			0.49			3
149 Trichloroethene	mg/kg (ppm)		0.41						
152 m-xylene	mg/kg (ppm)					1.3			8
153 o-xylene	mg/kg (ppm)					0.95			1
Total organics	mg/kg (ppm)	762	10	15	7	77	7	10	5
# Detectable organics		5	5	6	3	10	2	3	



Table B.1 (cont.)

EMS Parameter ID#	Units	SS5-1	SS5-2	SS6-1	SS6-2	SS7-1	SS7-2	SS8-1	SS8
1 Cyanide, total (CN)	mg/kg (ppm)	4.75	16.25	7.5	0.5	10	9	4	0.
2 Sulfide	mg/kg (ppm)								
3 PH		8	3.4	7.3	7.6	7.6	8.2	7.7	7
4 Arsenic	mg/kg (ppm)		7.6						
5 Barium	mg/kg (ppm)	1200	580				630		
6 Cadmium	mg/kg (ppm)	20	12	2.3		13.0	6.3	1.5	
7 Chromium	mg/kg (ppm)	430	110	68			370	210	
8 Lead	mg/kg (ppm)	3800	1600	480	38	110	1,000	200	
9 Mercury	mg/kg (ppm)								
10 Nickel	mg/kg (ppm)	69	75			32	28		
11 Selenium	mg/kg (ppm)								
12.5 Phenols	mg/kg (ppm)	0.3	2.0		0.2				
16 Anthracene	mg/kg (ppm)						1.2		
18 Benz(a)anthracene (est)	mg/kg (ppm)						0.83		
20 Benzo(b)fluoranthene (est)	mg/kg (ppm)	0.72					1.2		
24 Butyl benzyl phthalate	mg/kg (ppm)					1.6			
28 Bis(2-ethylhexyl)phthalate	mg/kg (ppm)	23		17	520	18	34	5.3	
34 Chrysene (est)	mg/kg (ppm)						0.97		
42 Dimethylphthalate (est)	mg/kg (ppm)								0.
43 Di-n-butyl phthalate	mg/kg (ppm)	2.1	6.4			3.4		3.6	
47 Di-n-octylphthalate	mg/kg (ppm)			31	450	22	13	27	
49 Fluoranthene (est)	mg/kg (ppm)	0.51	6.3			0.6	1.2		
50 Fluorene (est)	mg/kg (ppm)						0.77		
56 Isophorone (est)	mg/kg (ppm)	0.96				1.4			
57 2-Methylnaphthalene (est)	mg/kg (ppm)	0.63				0.63	8.0		
58 Naphthalene	mg/kg (ppm)	1.0			51	0.74	1.4		
65 Phenanthrene (est)	mg/kg (ppm)	0.77	4.7			0.90	4.0		0
67 Pyrene (est)	mg/kg (ppm)	0.53				0.72	1.4		
115 Benzene	mg/kg (ppm)								
119 Carbon disulfide	mg/kg (ppm)				16				
129 1,1-Dichloroethane	mg/kg (ppm)		0.44						
133 Ethylbenzene	mg/kg (ppm)	0.70		0.52	270	1.8	1.4	0.40	
134 Fluorotrichloromethane	mg/kg (ppm)	0.69							
136 Methylene chloride	mg/kg (ppm)	0.91	1.3	0.76		0.82	0.83	0.80	
138 Methyl ethyl ketone	mg/kg (ppm)	7.1	5.5	5.0		6.7		6.3	
140 Styrene	mg/kg (ppm)	0.94							
142 Tetrachloroethene	mg/kg (ppm)	1.3							
144 Toluene	mg/kg (ppm)	2.0	0.90		33	0.58	1.5		
149 Trichloroethene	mg/kg (ppm)	0.43							
152 m-xylene	mg/kg (ppm)	1.9		1.4	930	5.7	6.1	1.1	
153 o-xylene	mg/kg (ppm)	1.2		0.81	570	3.2	4.5	0.63	
Total organics	mg/kg (ppm)	48	28	56	2,840	69	82	45	
# Detectable organics		20	8	7	9	16	17	8	

Table B.1 (cont.)

EMS Parameter ID#	Units	SS9-1	SS13-1	SS9-2	SS13-2	SS10-1	SS10-2	SS11-1	SS11-2
1 Cyanide, total (CN)	mg/kg (ppm)	8	110	1.75		1	0.5	16	70
2 Sulfide	mg/kg (ppm)								
3 PH		7.7	7.6	7.6	7.6	7.7	7.6	7.4	7.3
4 Arsenic	mg/kg (ppm)							8.6	
5 Barium	mg/kg (ppm)	680	530						
6 Cadmium	mg/kg (ppm)	12	4.3	4.5	2.5	1.5		13	15
7 Chromium	mg/kg (ppm)	590	50	34		59	70		240
8 Lead	mg/kg (ppm)	38,000	2,800	50	75	360		1,900	230
9 Mercury	mg/kg (ppm)							2.1	
10 Nickel	mg/kg (ppm)	18	16						26
11 Selenium	mg/kg (ppm)								
12:5 Phenols	mg/kg (ppm)		30						6.0
16 Anthracene	mg/kg (ppm)								
18 Benz(a)anthracene (est)	mg/kg (ppm)								
20 Benzo(b)fluoranthene (est)	mg/kg (ppm)								
24 Butyl benzyl phthalate	mg/kg (ppm)								
28 Bis(2-ethylhexyl)phthalate	mg/kg (ppm)	90						85	
34 Chrysene (est)	mg/kg (ppm)								
42 Dimethylphthalate (est)	mg/kg (ppm)								
43 Di-n-butyl phthalate	mg/kg (ppm)	24	300	610	120	39	15	10	160
47 Di-n-octylphthalate	mg/kg (ppm)								
49 Fluoranthene (est)	mg/kg (ppm)								
50 Fluorene (est)	mg/kg (ppm)								
56 Isophorone (est)	mg/kg (ppm)								
57 2-Methylnaphthalene (est)	mg/kg (ppm)	5.9							
58 Naphthalene	mg/kg (ppm)	3.6							
65 Phenanthrene (est)	mg/kg (ppm)								
67 Pyrene (est)	mg/kg (ppm)								
115 Benzene	mg/kg (ppm)			0.38					
119 Carbon disulfide	mg/kg (ppm)								
129 1,1-Dichloroethane	mg/kg (ppm)						0.76		
133 Ethylbenzene	mg/kg (ppm)	150	48	0.46		0.47			
134 Fluorotrichloromethane	mg/kg (ppm)								
136 Methylene chloride	mg/kg (ppm)		32	0.79	0.79	0.83	0.85	0.85	
138 Methyl ethyl ketone	mg/kg (ppm)			7.0	7.6	7.1	7.3	6.7	
140 Styrene	mg/kg (ppm)								
142 Tetrachloroethene	mg/kg (ppm)								
144 Toluene	mg/kg (ppm)	210	93	1.4		0.79	0.43	0.82	3,300
149 Trichloroethene	mg/kg (ppm)								
152 m-xylene	mg/kg (ppm)	510	190	3.5	0.50	0.63		0.77	1,800
153 o-xylene	mg/kg (ppm)	340	150		0.39	0.43		0.65	1,100
Total organics	mg/kg (ppm)	1,334	843	624	129	49	24	105	6,366
# Detectable organics		8	7	7	5	7	5	7	5

Table B.1 (cont.)

EMS Parameter ID#	Units	SS12-1	SS12-2
1 Cyanide, total (CN)	mg/kg (ppm)		
2 Sulfide	mg/kg (ppm)		
3 PH		7.2	7.2
4 Arsenic	mg/kg (ppm)	140	
5 Barium	mg/kg (ppm)		
6 Cadmium	mg/kg (ppm)		
7 Chromium	mg/kg (ppm)		
8 Lead	mg/kg (ppm)	150	30
9 Mercury	mg/kg (ppm)		
10 Nickel	mg/kg (ppm)		
11 Selenium	mg/kg (ppm)		
12.5 Phenols	mg/kg (ppm)		
16 Anthracene	mg/kg (ppm)		
18 Benz(a)anthracene (est)	mg/kg (ppm)		
20 Benzo(b)fluoranthene (est)	mg/kg (ppm)		
24 Butyl benzyl phthalate	mg/kg (ppm)		
28 Bis(2-ethylhexyl)phthalate	mg/kg (ppm)		
34 Chrysene (est)	mg/kg (ppm)		
42 Dimethylphthalate (est)	mg/kg (ppm)		
43 Di-n-butyl phthalate	mg/kg (ppm)	23	30
47 Di-n-octylphthalate	mg/kg (ppm)		
49 Fluoranthene (est)	mg/kg (ppm)		
50 Fluorene (est)	mg/kg (ppm)		
56 Isophorone (est)	mg/kg (ppm)		
57 2-Methylnaphthalene (est)	mg/kg (ppm)		
58 Napthalene	mg/kg (ppm)		
65 Phenanthrene (est)	mg/kg (ppm)		
67 Pyrene (est)	mg/kg (ppm)		
115 Benzene	mg/kg (ppm)		
119 Carbon disulfide	mg/kg (ppm)		
129 1,1-Dichloroethane	mg/kg (ppm)		
133 Ethylbenzene	mg/kg (ppm)		
134 Fluorotrichloromethane	mg/kg (ppm)		
136 Methylene chloride	mg/kg (ppm)	0.80	0.78
138 Methyl ethyl ketone	mg/kg (ppm)	7.0	4.7
140 Styrene	mg/kg (ppm)		
142 Tetrachloroethene	mg/kg (ppm)		
144 Toluene	mg/kg (ppm)		
149 Trichloroethene	mg/kg (ppm)		
152 m-xylene	mg/kg (ppm)		
153 o-xylene	mg/kg (ppm)		
Total organics	mg/kg (ppm)	31	35
# Detectable organics		3	3

Table B.2 (cont.)

EMS Parameter ID#	Units	SD3-1	SD4-1	SD3-2	SD3-3	SD4-2	SP1
1 Cyanide, total (CN)	mg/kg (ppm)	17	17.5	1.0		1.25	
2 Sulfide	mg/kg (ppm)					1.5	2
3 PH		7.8	8.7	7.7	7.8	8.6	7.1
4 Arsenic	mg/kg (ppm)	19		130	17	23	
5 Barium	mg/kg (ppm)	830	730				
6 Cadmium	mg/kg (ppm)	16	16	7.3	6.8	7.5	
7 Chromium	mg/kg (ppm)	41	510	100	59	70	19
8 Lead	mg/kg (ppm)	1,900	2,000	170	120	170	58
9 Mercury	mg/kg (ppm)	2.5	2.2				
10 Nickel	mg/kg (ppm)	31	26	49	43	45	
11 Selenium	mg/kg (ppm)	3.1		5	3.8	3.9	
12.5 Phenols	mg/kg (ppm)	0.2	0.2				
16 Anthracene	mg/kg (ppm)						
18 Benz(a)anthracene (est)	mg/kg (ppm)						
20 Benzo(b)fluoranthene (est)	mg/kg (ppm)						
24 Butyl benzyl phthalate	mg/kg (ppm)						
28 Bis(2-ethylhexyl)phthalate	mg/kg (ppm)	2,000	19	4.2			
34 Chrysene (est)	mg/kg (ppm)						
42 Dimethylphthalate (est)	mg/kg (ppm)						
43 Di-n-butyl phthalate	mg/kg (ppm)	970		2.8			
47 Di-n-octylphthalate	mg/kg (ppm)		36	50			
49 Fluoranthene (est)	mg/kg (ppm)						
50 Fluorene (est)	mg/kg (ppm)						
56 Isophorone (est)	mg/kg (ppm)		1.7				
57 2-Methylnaphthalene (est)	mg/kg (ppm)						
58 Napthalene	mg/kg (ppm)		1.2	3.7			
65 Phenanthrene (est)	mg/kg (ppm)						
67 Pyrene (est)	mg/kg (ppm)						
115 Benzene	mg/kg (ppm)						
119 Carbon disulfide	mg/kg (ppm)						
129 1,1-Dichloroethane	mg/kg (ppm)						
133 Ethylbenzene	mg/kg (ppm)	0.38	1.0	0.42	5.8	1.0	
134 Fluorotrichloromethane	mg/kg (ppm)						
136 Methylene chloride	mg/kg (ppm)	0.74	0.81	0.72	0.77	0.72	0.61
138 Methyl ethyl ketone	mg/kg (ppm)	7.8	6.5	7.0	6.7	4.9	7.7
140 Styrene	mg/kg (ppm)						
142 Tetrachloroethene	mg/kg (ppm)						
144 Toluene	mg/kg (ppm)	0.86	5.0		0.37		0.54
149 Trichloroethene	mg/kg (ppm)						
152 m-xylene	mg/kg (ppm)	0.97	2.3		0.70	0.78	0.78
153 o-xylene	mg/kg (ppm)	0.82	1.9	0.41	1.6	1.1	
Total organics	mg/kg (ppm)	2,982	76	69	16	9	10
# Detectable organics		9	11	8	6	5	4